

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): An isolated or purified polynucleotide that encodes a polypeptide having at least 95% identity to residues 13-555 of SEQ ID NO: 26 and that has at least one mutation at an amino acid residue between residue 461 to 490 of SEQ ID NO: 26, that includes a mutation at W550, and that has DNA polymerase activity

~~or~~

~~at a residue in SEQ ID NO: 26 selected from the group consisting of residue H203, F205, T232, E253, Q257, D274, L275, I276, V309, I322, A331, L332, D333, Y334, S335, I361, R374, A384, T387, Y419, P493, M498, G499, M502, L503, V506, R518, A523, A526, P539, E543, and W550.~~

Claim 2 (Previously Presented) The isolated or purified polynucleotide of Claim 1, that has at least one mutation at an amino acid residue between residue 461 to 490 of SEQ ID NO: 26.

Claim 3 (Previously Presented): The isolated or purified polynucleotide of Claim 1, wherein said polypeptide has at least one mutation in amino acids 461 to 490 of SEQ ID NO: 26, or at a position selected from the group consisting of H203, F205, T232, E253, Q257, D274, L275, I276, V309, I322, A331, L332, D333, Y334, S335, I361, R374, A384, T387, Y419, P493, M498, G499, M502, L503, V506, R518, A523, A526, P539, E543, and W550.

Claim 4 (Previously Presented): The isolated or purified polynucleotide of Claim 1, that encodes a polypeptide having at least one mutation selected from the group consisting of A331T, S335N, M470K, M470R, F472Y, M484V, M484T, R518, and W550R.

Claim 5 (Previously Presented): The isolated or purified polynucleotide of Claim 1, wherein said polypeptide has at least 97.5% identity to residues 13-555 of SEQ ID NO: 26.

Claim 6 (Previously Presented): The isolated or purified polynucleotide of Claim 1, wherein said polypeptide comprises at least two mutations.

Claim 7 (Withdrawn): The isolated or purified polynucleotide of Claim 1, that encodes an amino acid sequence selected from the group consisting of SEQ ED NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, and SEQ ID NO: 38.

Claim 8 (Withdrawn): The purified polynucleotide of Claim 1, that encodes a polypeptide that has a mutation at R518.

Claim 9 (Withdrawn): The isolated or purified polynucleotide of Claim 8, that encodes a polypeptide that has a mutation R518G.

Claim 10 (Previously Presented): The isolated or purified polynucleotide of Claim 1, that encodes a polypeptide that has at least one mutation selected from the group consisting of H203R, F205L, T232S, E253G, Q257R, D274G, L275H, L275P, I276F, V309I, I322N, A331V, S335N, I361F, R374Q, A384T, T387A, Y419C, Y419N, E465K, M470K, M470R, F472Y, F472S, A487T, K490E, P493T, M498T, G499E, M502K, L503P, V506I, R518G, A523V, A526V, P539S, E543K, and W550R.

Claim 11 (Withdrawn): The isolated or purified polynucleotide of Claim 10, that encodes a polypeptide that comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, SEQ ID NO: 77, SEQ ID NO: 79, SEQ ID NO: 81, SEQ ID NO: 83, SEQ ID NO: 85, SEQ ID NO: 87, SEQ ID NO: 89, SEQ ID NO: 91, SEQ ID NO: 93, SEQ ID NO: 95, SEQ ID NO: 97, and SEQ ID NO: 99.

Claim 12 (Previously Presented): The isolated or purified polynucleotide of Claim 1, that comprises a sequence selected from the group consisting of SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, and SEQ ID NO: 37.

Claim 13 (Withdrawn): The isolated or purified polynucleotide of Claim 1, that comprises a polynucleotide sequence selected from the group consisting of SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, SEQ ID NO: 78, SEQ ID NO: 80, SEQ ID NO: 82, SEQ ID NO: 84, SEQ ID NO: 86, SEQ ID NO: 88, SEQ ID NO: 90, SEQ ID NO: 92, SEQ ID NO: 94, SEQ ID NO: 96, and SEQ ID NO: 98.

Claim 14 (Previously Presented): An isolated or purified polynucleotide that is complementary to the polynucleotide of Claim 1.

Claim 15 (Previously Presented): An isolated or purified polynucleotide that hybridizes under stringent conditions to the polynucleotide of Claim 1, wherein said stringent conditions comprise washing in 5X SSC at a temperature ranging from 50°C to 68°C.

Claim 16 (Previously Presented): A vector comprising the isolated or purified polynucleotide of Claim 1.

Claim 17 (Original): The vector of Claim 16, wherein said polynucleotide is operably linked to a heterologous expression sequence.

Claim 18 (Previously Presented): A host cell comprising the isolated or purified polynucleotide of Claim 1.

Claim 19 (Withdrawn): An isolated or purified polypeptide comprising an amino acid sequence having at least 80% identity to residues 13-555 of SEQ ID NO: 26, wherein said polypeptide has at least one mutation in amino acids 461 to 490 of SEQ ID NO: 26, or at a position selected from the group consisting of H203, F205, T232, E253, Q257, D274, L275, I276, V309, I322, A331, L332, D333, Y334, S335, I361, R374, A384, T387, Y419, P493, M498, G499, M502, L503, V506, R518, A523, A526, P539, E543, and W550.

Claim 20 (Withdrawn): The isolated or purified polypeptide of Claim 19 that has at least one mutation selected from the group consisting of A331T, S335N, M470K, M470R, F472Y, M484V, M484T, R518G, and W550R.

Claim 21 (Withdrawn): The isolated or purified polypeptide of Claim 19 that has at least 90% identity to residues 13-555 of SEQ ID NO: 26.

Claim 22 (Withdrawn): The isolated or purified polypeptide of Claim 19, wherein said polypeptide has at least 95% identity to residues 13-555 of SEQ ID NO: 26.

Claim 23 (Withdrawn): The isolated or purified polypeptide of Claim 19, wherein said polypeptide has at least 97.5% identity to residues 13-555 of SEQ ID NO: 26.

Claim 24 (Withdrawn): The isolated or purified polypeptide of Claim 19 that comprises at least two mutations.

Claim 25 (Withdrawn): The purified polypeptide of Claim 19, that comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, and SEQ ID NO: 38.

Claim 26 (Withdrawn): The isolated or purified polypeptide of Claim 19 that has a mutation at R518.

Claim 27 (Withdrawn): The isolated or purified polypeptide of Claim 26 that has the mutation R518G.

Claim 28 (Withdrawn): The isolated or purified polypeptide of Claim 19 that has at least one mutation is selected from the group consisting of H203R, F205L, T232S, E253G, Q257R, D274G, L275H, L275P, I276F, V309I, I322N, A331V, S335N, I361F, R374Q, A384T, T387A, Y419C, Y419N, E465K, M470K, M470R, F472Y, F472S, A487T, K490E,

P493T, M498T, G499E, M502K, L503P, V506I, R518G, A523V, A526V, P539S, E543K,  
and W550R.

Claim 29 (Withdrawn): The isolated or purified polypeptide of Claim 28 that comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, SEQ ID NO: 77, SEQ ID NO: 79, SEQ ID NO: 81, SEQ ID NO: 83, SEQ ID NO: 85, SEQ ID NO: 87, SEQ ID NO: 89, SEQ ID NO: 91, SEQ ID NO: 93, SEQ ID NO: 95, SEQ ID NO: 97, and SEQ ID NO: 99.

Claim 30 (Withdrawn): A kit for amplifying DNA comprising:  
the polypeptide of claim 1;  
a concentrated buffer solution, and optionally one or more divalent metal ions; and  
a mixture of deoxyribonucleotides.

Claim 31 (Withdrawn) The kit of Claim 30, wherein said polypeptide contains at least one mutation selected from the group consisting of A331T, S335N, M470K, M470R, F472Y, M484V, M484T, R518G, and W550R.

Claim 32 (Withdrawn) The kit of Claim 30 that comprises a divalent metal ion that is  $Mg^{2+}$  or  $Mn^{2+}$ .

Claim 33 (Withdrawn): The kit of Claim 30, wherein said polypeptide has at least 90% identity to residues 13-555 of SEQ ID NO: 26.

Claim 34 (Withdrawn): The kit of Claim 30, wherein said polypeptide has at least 95% identity to residues 13-555 of SEQ ID NO: 26.

Claim 35 (Withdrawn): The kit of Claim 30, wherein said polypeptide has at least 97.5% identity to residues 13-555 of SEQ ID NO: 26.

Claim 36 (Withdrawn): The kit of Claim 30, wherein said polypeptide comprises at least two mutations.

Claim 37 (Withdrawn): The kit of Claim 30, wherein said polypeptide comprises an amino acid sequence corresponding to residues 13-555 of a sequence selected from the group consisting of SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, and SEQ ID NO: 38.

Claim 38 (Withdrawn): The kit of Claim 30, wherein said polypeptide has a mutation at R518.

Claim 39 (Withdrawn): The kit of Claim 38, wherein said mutation at R518 is R51G.

Claim 40 (Withdrawn): The kit of Claim 30, wherein said at least one mutation is selected from the group consisting of H203R, F205L, T232S, E253G, Q257R, D274G, L275H, L275P, I276F, V309I, I322N, A331V, S335N, I361F, R374Q, A384T, T387A, Y419C, Y419N, E465K, M470K, M470R, F472Y, F472S, A487T, K490E, P493T, M498T, G499E, M502K, L503P, V506I, R518G, A523V, A526V, P539S, E543K, and W550R.

Claim 41 (Withdrawn): The kit of Claim 40, wherein said polypeptide comprises an amino acid sequence corresponding to residues 1-543 of a sequence selected from the group consisting of SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, SEQ ID NO: 77, SEQ ID NO: 79, SEQ ID NO: 81, SEQ ID NO: 83, SEQ ID NO: 85, SEQ ID NO: 87, SEQ ID NO: 89, SEQ ID NO: 91, SEQ ID NO: 93, SEQ ID NO: 95, SEQ ID NO: 97, and SEQ ID NO: 99.

Claim 42 (Withdrawn): The kit of Claim 30, further comprising a 5' to 3' exonuclease or a 3' to 5' exonuclease.

Claim 43 (Withdrawn): The kit of Claim 42, wherein said 5' to 3' exonuclease has a sequence of SEQ ID NO: 50.

Claim 44 (Withdrawn): The kit of Claim 42, wherein said 3' to 5' exonuclease has a sequence of SEQ ID NO: 51.

Claim 45 (Withdrawn): A method for reverse transcribing an RNA comprising:

a) providing a reverse transcription reaction mixture comprising said RNA, a primer, a divalent cation, and a purified thermostable polypeptide comprising an amino acid sequence having at least 80% identity to residues 13-555 of SEQ ID NO: 26, wherein said polypeptide has at least one mutation in amino acids 461 to 490 of SEQ ID NO: 26, or at a position selected from the group consisting of H203, F205, T232, E253, Q257, D274, L275, I276, V309, I322, A331, L332, D333, Y334, S335, I361, R374, A384, T387, Y419, M470, F472, M484, P493, M498, G499, M502, L503, V506, R518, A523, A526, P539, E543, and W550, and wherein said polypeptide has DNA polymerase activity; and



b) treating said reaction mixture at a temperature and under conditions suitable for said purified polypeptide to initiate synthesis of an extension product of said primer to provide a cDNA molecule complementary to said RNA.

Claim 46 (Withdrawn): The method of Claim 45, wherein said at least one mutation is selected from the group consisting of A331T, S335N, M470K, M470R, F472Y, M484V, M484T, R518G, and W550R.

Claim 47 (Withdrawn): The method of Claim 45, wherein said at least one mutation is selected from the group consisting of H203R, F205L, T232S, E253G, Q257R, D274G, L275H, L275P, I276F, V309I, I322N, A331V, S335N, I361F, R374Q, A384T, T387A, Y419C, Y419N, E465K, M470K, M470R, F472Y, F472S, A487T, K490E, P493T, M498T, G499E, M502K, L503P, V506I, R518G, A523V, A526V, P539S, E543K, and W550R.

Claim 48 (Withdrawn) A method of identifying thermostable mutant polypeptides comprising:

- a) packaging a vector in which a polynucleotide encoding a phage coat protein is fused to a polynucleotide encoding a protein having at least 80% identity to residues 13-555 of SEQ ID NO: 26 into a phage;
- b) expressing the fusion protein;
- c) isolation of phage particles;
- d) infecting *E. coli* and incubating the infected *E. coli*;
- e) detecting the fusion protein; and
- f) assessing polymerase activity.

Claim 49 (Withdrawn): The method of Claim 48, wherein b) to f) are repeated 0 to 25 times.

Claim 50 (Withdrawn): The method of Claim 48, wherein the phage coat protein is fused to said polynucleotide encoding a protein having at least 80% identity to residues 13-555 of SEQ ID NO: 26 by way of a linker having a sequence represented by residues 3-12 of SEQ ID NO: 39.

Claim 51 (Withdrawn): A method of identifying thermostable mutant polypeptides having a catalytic activity comprising:

- a) packaging a vector in which a gene or fragment thereof encoding variants of a catalytic domain responsible for the catalytic activity fused to a gene encoding a phage coat protein;
- b) isolation and purification of phage particles;
- c) heating the phage-mutant polypeptide at a temperature ranging from 50°C to 90°C for a time ranging from 30 seconds to several hours;
- d) cross-linking a specific substrate with a phage particle;
- e) forming a reaction product from the substrate catalyzed by the thermostable mutant protein on phage, wherein the temperature is optionally regulated to be the same or greater or lower than the temperature of c);
- f) selecting the phage particles comprising a variant nucleotide sequence encoding for the catalytic domain responsible for the catalytic activity at the regulated temperature, by capturing the reaction product or screening for said reaction product;
- g) infecting *E. coli* with the phage particles selected at f);
- h) incubating the infected *E. coli*; and

i) assessing catalytic activity of the proteins corresponding to isolated genes.

Claim 52 (Withdrawn): The method of Claim 51, wherein the gene or fragment thereof encoding variants of a catalytic domain is directly fused to the gene encoding a phage coat protein.

Claim 53 (Withdrawn): The method of Claim 51, wherein a) to h) are repeated 0 to 20 times.

Claim 54 (Withdrawn): The method of Claim 51, wherein the gene or fragment thereof encoding variants of a catalytic domain and the gene encoding a phage coat protein, are indirectly fused by a peptide or polypeptide linker.

Claim 55 (Withdrawn): The method of Claim 54, wherein the peptide is selected from the group consisting of:

a glycine rich linker represented by  $(SG_4)_n$  (SEQ ID NO: 107);

a glycine rich linker represented by  $SG_4CG_4$  (residues 3-12 of SEQ ID NO: 39);

a human calmodulin (SEQ ID NO: 46); and

a hexahistidine (SEQ ID NO: 108) binding single chain variable fragment consisting

of:

(i) an anti-His Tag Antibody 3D5 Variable Heavy Chain (SEQ ID NO: 47);

(ii) a linker (SEQ ID NO: 48); and

(iii) an anti-His Tag Antibody 3D5 Variable Light Chain (SEQ ID NO: 49).

Claim 56 (Withdrawn): The method of Claim 54, wherein the polypeptide linker is selected from the group consisting of:

- a protein binding the substrate at high temperature;
- a catalytic domain of a 5' to 3' exonuclease;
- a catalytic domain of a 3' to 5' exonuclease;
- a catalytic domain of *Bacillus circulans* cyclodextringlycosyltransferase (SEQ ID NO: 52);
- a catalytic domain of *Bordetella pertussis* adenylate cyclase (SEQ ID NO: 53);
- (SEQ ID NO: 54); and
- a catalytic domain of *Bacillus subtilis* lipase A (SEQ ID NO: 55).

Claim 57 (Withdrawn): The method of Claim 51, wherein the cross-linking between the specific substrate of the catalytic domain of the polypeptide with the phage particle is made by a cross-linking agent selected from the group consisting of:

- a maleimidyl group;
- an iodoacetyl group disulfide derivative; and
- any other thermostable link.

Claim 58 (Withdrawn): The method of Claim 51, wherein the catalytic domain is the catalytic domain of an enzyme selected from the group consisting of:

- a DNA polymerase;
- an alpha-amylase;
- a lipase;
- a protease;
- a cyclodextringlycosyltransferase; and

an adenylate cyclase.

Claim 59 (Withdrawn): The method of Claim 51, wherein the assessment of the catalytic activity of f) is made by means of a DNA polymerization.

Claim 60 (Withdrawn): The method of Claim 51, wherein b) is performed after e) or during h).

Claim 61 (Withdrawn): The method of Claim 51, wherein the temperature in e) is regulated to be the same or greater than the temperature of c).

Claim 62 (Withdrawn): The method of Claim 51, wherein the temperature in e) is regulated to be the same or less than the temperature of c).

Claim 63 (Withdrawn): A method of obtaining a thermostable variant enzyme comprising:

a) screening enzymes expressed at the surface of phage particles and identifying at least a thermostable variant conserving its active catalytic domain at a regulated temperature according to the method of Claim 62;

b) isolating and sequencing a DNA encoding said identified thermostable variant;

c) preparing a vector comprising the DNA of b);

d) transfecting or infecting cells with the vector obtained at c);

e) expressing the thermostable variant enzyme from the cells and optionally; and

f) recovering, isolating and purifying said thermostable variant enzyme expressed at

e).

Claim 64 (Withdrawn): A method of obtaining a thermostable variant enzyme comprising:

a) screening enzymes expressed at the surface of phage particles and identifying at least a thermostable variant conserving its active catalytic domain at a regulated temperature according to the method of Claim 61;

b) isolating and sequencing a DNA encoding said identified thermostable variant;

c) preparing a vector comprising the DNA of b);

d) transfecting or infecting cells with the vector obtained at c);

e) expressing the thermostable variant enzyme from the cells and optionally; and

f) recovering, isolating and purifying said thermostable variant enzyme expressed at e).

Claim 65 (Currently Amended): A monoclonal phage selected from the group consisting of a phage deposited under accession number I-3168, I-3169, I-3170, [[I-3171,]] I-3172, I-3173, I-3174, I-3175, [[I-3176]] and I-3158 in CNCM on February 27, 2004.

Claim 66 (Previously Presented): A recombinant host cell comprising the phage of claim 65 or a nucleic acid of said phage.